

LABORATORY DIAGNOSIS OF SMALLPOX

CONTENTS

	Page
Part I. Introduction and Notes on the Laboratory Diagnosis of Smallpox	3
Part II. Laboratory Diagnosis of Smallpox by F. O. MacCallum, M.D., B.Sc....	4
Part III. Laboratories available for the laboratory diagnosis of smallpox	9
Part IV. Practitioners designated to assist Medical Officers of Health in the diagnosis of smallpox	10

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PART I

Introduction

The following notes explain the value and limitations of laboratory methods in the diagnosis of smallpox. They are intended for the use of Medical Officers of Health, Medical Officers at seaports and airports, and members of the panel of practitioners designated to assist Medical Officers of Health in the diagnosis of smallpox. The notes set out the most recent information and advice which it has been possible to obtain from authoritative sources.

NOTES ON THE LABORATORY DIAGNOSIS OF SMALLPOX

Although the results of laboratory findings in cases of suspected smallpox can be of very great value in confirming the clinical diagnosis, they cannot at present be considered capable of replacing it. Indeed, a negative result from the laboratory may in certain circumstances be misleading, depending on the stage of the disease and the quantity of material sent for examination. For this reason, a negative laboratory result should be ignored in the face of persistent clinical suspicion until the laboratory tests have been repeated. Negative results in tests 2 and 3 will only occur in cases of true smallpox if the material is collected from non-specific lesions or is insufficient in amount. Similarly, in test 3 suspicion of a positive result could arise out of artefacts in the primary culture in the laboratory. In these circumstances the laboratory may wish to delay its report for a further 48 hours.

A. Tests on Material from Lesions

1. *Direct microscopical examination of smears from early lesions.* This may provide the most rapid confirmation of a clinical diagnosis, but a negative result does not exclude the diagnosis of smallpox, for much depends on the care with which material is taken and upon the stage of the rash at the time. The test is not reliable when the rash is fully pustular or in the crusting stage.

2. *Complement fixation test.* If sufficient material is available, this test will provide a result in 24 hours and a positive result will distinguish variola, vaccinia and cowpox from chickenpox, herpes and any indeterminate rash.

A negative result from this test is more reliable than a negative result from direct microscopic examination of smears, but it is of doubtful significance if the amount of material is very small, e.g., less than 6 crusts, or less than 1 capillary tube from vesicle or pustule.

3. *Egg culture.* A positive result in 48 to 72 hours from egg culture usually permits exact identification of the aetiological agent, though no distinction is possible between variola major and variola minor. A negative result is unlikely to be misleading if the laboratory has been provided with adequate material and if this material has **not** been heated or come into contact with disinfectant.

Occasionally egg culture from the blood of a febrile contact may give a diagnostic growth by the time the rash appears.

B. Antibody Tests on Blood

4. From the seventh day of illness onwards these tests on the serum of a patient who has not been vaccinated within the past year will give a significant result, and the result should be available the day after the serum is received. Haemolysed serum is of no value.

In all the tests success and interpretation of results are influenced by the amount of material received by the laboratories, and it is essential that as much as possible should be sent in every case. Where possible, the nearest reference laboratory should be consulted before material is collected from the patient.

The paper by Dr. F. O. MacCallum, Director of the Virus Reference Laboratory, Central Public Health Laboratory, Colindale, reproduced in Part II of this document gives, among other things, details of the methods of collection of material for these tests. A useful reference is also contained in Chapter 7 (by Downie) of "Virus and Rickettsial Diseases" by Bedson *et al.*, published by Edward Arnold, London, 1950.

PART II

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LABORATORY DIAGNOSIS OF SMALLPOX

by F. O. MACCALLUM, M.D., B.SC.,

Director, Virus Reference Laboratory, Central Public Health Laboratory, Colindale, London, N.W.9

In recent years smallpox has usually been imported into Great Britain from India by an individual suffering from the disease in a form which has not been recognized as variola when first seen by a physician. The disease has usually been diagnosed as chicken-pox. This fact, coupled with the low vaccination rate prevalent in the country, makes it obvious that the use of laboratory methods to aid in the early diagnosis is of great importance in an attempt to prevent the unnecessary wastage of human life, money and labour which result from the importation of smallpox.

When medical officers at a port or elsewhere see a patient with an exanthematous disease that might or might not be smallpox, they make an immediate assessment on clinical grounds and take whatever steps are necessary in relation to the situation. However, having done this, the medical officer can then be aided by the results of the laboratory tests to make further dispositions. If the clinical diagnosis of variola is confirmed, he is safe; if his diagnosis suspecting variola has been wrong, he can release his isolated contacts and ease control; if his diagnosis of probable varicella is wrong and the laboratory finds variola, the necessary instruction for isolation and control can be given immediately.

One of the first steps we have taken to use the laboratory to cut off the danger at its source has been the provision of equipment and instructions for collection of specimens from suspected patients on board ships of one of the main passenger shipping lines from India. This material is then flown to England from the next port of call, with the aim of having a diagnosis before the ship reaches Great Britain. There is, of course, no means of preventing the importation by air if the disease is in the incubation period; and it was an air passenger who initiated the Brighton outbreak.

I shall not describe the details of the techniques used in the laboratory or the history of their development, both of which have been adequately dealt with by Downie in recent years. I shall confine myself to a practical consideration of the collection of necessary specimens at different stages and the time required to obtain an answer in various circumstances with some examples of results in particular patients in recent outbreaks, including that at Brighton.

The instructions at the end of this paper are those enclosed with the outfits for collecting specimens supplied to the ships' surgeons travelling from the Far East, but an additional request for blood specimens has been included here. The request for blood specimens from patients from ships is omitted because of the effect on them of tropical conditions and the possible long duration of time before arrival at the laboratory in London.

The results of the laboratory tests may be available from within a few hours to three days of receipt of the material, depending on the stage of the illness when the patient is seen and the amount of material sent to the laboratory. When the tests are considered in relation to the specimens requested, it is readily seen why the stress is laid on maximum quantities. The three types of test available are: (1) microscopic examination of a stained smear; (2) complement fixation tests with the suspected material (blood, papule scrapings, vesicle fluid or crusts) as antigen and a known positive hyper-immune vaccinia rabbit anti-serum or with the patient's serum (if not recently vaccinated), and a known positive variola or vaccinia antigen; (3) culture on the chorioallantoic membrane (C.A.M.) of ten to twelve-day-old fertile hens' eggs.

It is probably best to discuss the problem with the most unsatisfactory case with few lesions as the example. With this in mind, the tests are considered in the reverse order to the instructions because the most sensitive and specific test is the egg culture, although it takes the longest. Thus, if only one smear, or a single drop of vesicle or pustule fluid, or one tiny crust is received at the laboratory (and this small amount is the rule), it must all be used to inoculate two or three eggs, and an answer will not be available until forty-eight to seventy-two hours. This culture will detect as few as one to six particles of living virus. If growth occurs there will be whitish spots on the C.A.M., whose exact size,

shape and general appearance will usually be characteristic, depending upon whether they are caused by growth of variola, vaccinia, cowpox or *herpes simplex*. If there are no lesions, the patient is likely to be suffering from varicella, as this virus has not been grown on the C.A.M. of fertile hens' eggs (or in any experimental animal).

If more than one slide, capillary of fluid or crust, or blood, are sent, this extra material will be used for the complement fixation test. This test is not so delicate or quite so specific as egg culture, but its virtue is its speed: *an answer may be available late the same day or early the day following receipt of material*. A positive answer is diagnostic for variola or vaccinia or cowpox. A negative answer on an adequate amount of material is also significant, but the significance of a negative answer on a small quantity of material must be determined by the type of material in each individual case. This test determines only whether the agent is a member of the variola-vaccinia-cowpox group or not. Egg culture will be necessary to identify which of these three is responsible. Varicella virus and *herpes simplex* will give negative results with the vaccinia immune serum in this test.

If four smears are available in stage one, or a smear in addition to other material in later stages, it can be stained, and if suitably prepared a presumptive diagnosis can be made within an hour of receipt in the laboratory. Thus, it is obvious that, wherever possible, it pays to make an adequate number of smears.

Lastly, egg culture of blood from febrile contacts may give diagnostic growth by the time the rash appears on the patient.

EXAMPLES OF APPLICATION OF THE ABOVE TESTS ON MINIMAL AMOUNTS OF MATERIAL FROM INDIVIDUAL PATIENTS

(1) *Papular rash in unvaccinated elderly female*

Complement fixation test positive on two smears from papules.
Egg culture positive on one smear from papule.

(2) *Macular stage in unvaccinated young adult male*

Egg culture positive on washing from venepuncture needle pushed through a macule.

(3) *Young adult female, vaccinated previous day*

Needle scraping of one spot several hours before general rash gave positive egg culture with several hundred pocks. Culture of serum taken at the same time showed thirty pocks per 0.1 ml.

(4) *Female vaccinated forty-seven years previously*

Needle scraping of one spot, thought to be acne, several hours before general rash, gave several hundred pocks on egg culture.

Some examples of the value of serological tests are given in the following Table. Patients (1) and (2) were smallpox contacts who developed a mild febrile illness with a doubtful rash. Patient (3) developed vaccinia in a cut on one finger while nursing a recently vaccinated infant.

Patient	Specimen	Days of exposure	Days since onset	Last vaccination	Re-vaccination	Variola C.F.T.	Vaccinia		Culture of lesion
							C.F.T.	H.-I.	
(1) S.	1	? 16	2	8 years	0 (neg.)	1/10*	1/10	1/10	Negative
	2	? 28	14	12 days	12 days	1/40	1/80	1/20	
(2) P.	1	? 11	5	20 years	0 (neg.)	1/20	1/5	1/40	Negative
	2	? 23	17	12 days	12 days	1/40	1/80	1/80	
(3) B.	1	10	3	0	0	0	0	0	Positive vaccinia
	2	29	22	0	0	0	N.D.	1/160	
	3	60	53	0	0	0	0	1/80	

C.F.T. = Complement-fixing antibody titre.

H.-I. = Haemagglutination-inhibition titre.

0 (neg.) = Vaccination same day as blood collection. Reaction—no take.

1/10* = Dilution of serum giving positive reaction.

Complement-fixing antibody in serum seldom remains positive longer than nine months. Positive results in contacts unvaccinated for some years, as in cases (1) and (2), is significant, particularly when revaccination is unsuccessful. There has obviously been a very sharp response to the secondary stimulus acting on a basic immunity in these two individuals. It can be seen that some patients with a single vaccinia lesion, either purposeful or accidental (case 3) may fail to develop complement-fixing antibody, although haemagglutination-inhibiting antibody, which is closely related to neutralizing antibody, can be detected in high titre.

Summary

A brief outline has been given of the possible uses of the laboratory as an aid to the diagnosis of smallpox. Details of the specimens required, the tests for which they are used, and some examples of the results obtained are briefly described.

The main points to remember are that with an adequate amount of material a definite answer is available within twenty-four hours, and that culture of the blood from a contact in the febrile pre-eruptive stage may give a diagnosis by the time the first rash is apparent.

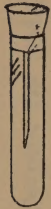
INSTRUCTIONS FOR COLLECTING AND DISPATCHING SPECIMENS

Smallpox Outfits

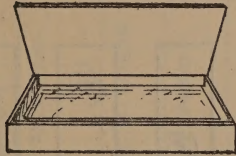
The outfit normally supplied for collecting specimens consists of the six articles illustrated below. Outfits are ordinarily obtainable from Messrs. R. B. Turner and Co., 9, Eagle Street, LONDON, W.C. 1.

In an emergency any of the laboratories listed in Part III of this document will supply an outfit.

SMALLPOX OUTFIT



1 NEEDLE



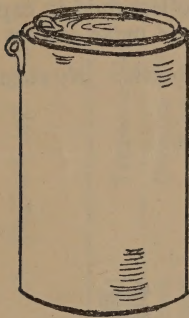
1 BOX CONTAINING
4 GLASS SLIDES



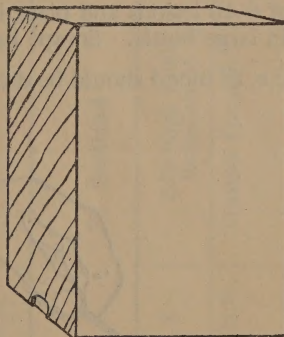
1 BOTTLE (LARGE)
WITH CAPILLARY TUBING



1 BOTTLE
(SMALL)



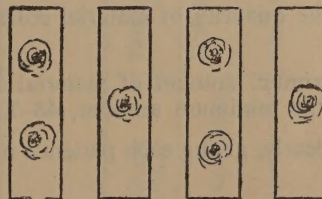
IN METAL CONTAINER



PACKED IN CARDBOARD BOX
WITH INSTRUCTIONS

Method of Collection

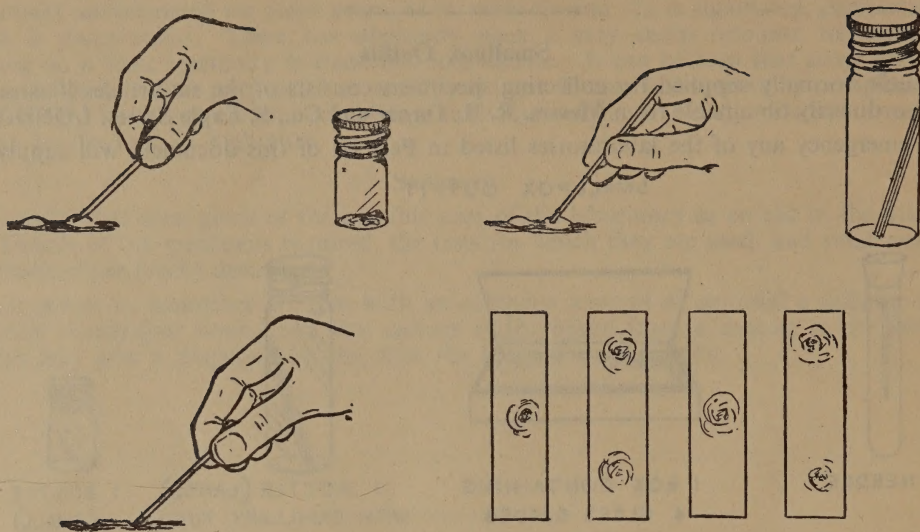
Maculo-papular rash



Clean skin with ether, ether-meths, or methylated spirit. Scrape at least 6 lesions (if present) with needle and make 6 thick smears on 4 glass slides. Allow smears to dry in air. *Do not heat.* Place each pair of slides face to face but separated by paper or match-stick so that they will not stick together, and return to box. Return needle in tube.

For blood tests, 10 c.c. of blood should be drawn in a dry sterile bottle. *No citrate should be added.*

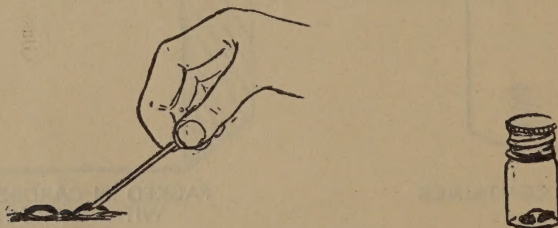
Vesicular and pustular stage



Remove tops of 6-10 lesions and place in small bottle. Collect fluid in capillary tubes and replace in large bottle. Scrape base of 4-6 lesions and make smears as above.

For blood tests, 10 c.c. of blood should be drawn in a dry sterile bottle. *No citrate should be added.*

Crusting stage



Remove as many scabs as possible up to 12 and place in small bottle.

In addition, 10 ml. blood should be taken from febrile contacts.

The greater the quantity of material collected, the better the laboratory will be able to interpret results.

With the maximum amount of material an answer will be available 2-24 hours after receipt of specimens; with the minimum amount, 48-72 hours.

Please label clearly, giving each patient's name, age and previous vaccination history.

Dispatching

All the articles received with the outfit, **whether they have been used or not**, should be included in the package, which should be addressed to the appropriate laboratory. The package should be marked **URGENT** and sent by Express Post or by passenger train.

PART III

LIST OF LABORATORIES AVAILABLE FOR THE LABORATORY DIAGNOSIS OF SMALLPOX

A. England and Wales

Laboratory	Address	Telephone No.	Pathologist	Notes
The Virus Reference Laboratory	Central Public Health Laboratory, Colindale Avenue, The Hyde, London, N.W.9.	Colindale 7041 (8 lines)	Dr. F. O. MacCallum	Telegraphic address: "Defender, Norphane, London"
Department of Bacteriology, University of Liverpool.	School of Hygiene, Mount Pleasant, Liverpool, 3.	Liverpool Royal 6022*, Extension 200	Professor A. W. Downie	*Royal 3636 after 5 p.m. Saturday and on Sunday.
Manchester Regional Public Health Laboratory.	Monsall Hospital, Newton Heath, Manchester, 10.	Collyhurst 2733	Dr. M. T. Parker	Complement fixation test only.
Cardiff Regional Public Health Laboratory.	Institute of Preventive Medicine, The Parade, Cardiff.	Cardiff 29110	Dr. Scott Thomson	Complement fixation test only.

9

B. Scotland

Department of Bacteriology, University of Edinburgh.	Teviot Row, Edinburgh, 8.	Edinburgh 41001 Extension 35	Dr. R. H. A. Swain	—
The Virus Laboratory, Infectious Diseases Department, Ruchill Hospital.	Bilsland Drive, Glasgow, N.W.	Glasgow Maryhill 3232	Dr. N. R. Grist	—

C. Northern Ireland

Tests cannot be undertaken but—

The Northern Ireland Hospitals Authority, Central Laboratory, 51, Lisburn Road, Belfast will act as agents for the transmission of specimens to appropriate laboratories.

PART IV

PRACTITIONERS DESIGNATED TO ASSIST MEDICAL OFFICERS OF HEALTH IN THE DIAGNOSIS OF SMALLPOX

ENGLAND AND WALES

Newcastle Regional Hospital Area—No. 1

District	Name	Address	Hospital, Office or Surgery Telephone No.	Home Telephone No.
Carlisle, and parts of Cumberland adjacent to Carlisle.	Dr. J. Beard	8, Carlton Gardens, CARLISLE, Cumberland.	—	Carlisle 2323
Cumberland and Westmor- land.	Dr. R. W. Farquhar	Victoria House, Regent Street, LANCASTER.	Lancaster 4353	Caton 194
Durham County	Dr. E. Thorp	13, The Broadway, Grindon, SUNDERLAND, Co. Durham.	—	Sunderland 6506
Durham and Northumber- land Counties.	Dr. M. Herbst	Greenesfield House, GATESHEAD, Co. Durham.	Gateshead 71187	Gateshead 71845
„ „ „	Dr. J. Grant	Greenesfield House, GATESHEAD, Co. Durham.	Gateshead 71187 and 76787	Gateshead 75035
„ „ „	Dr. W. Minns	County Hall, NEWCASTLE ON TYNE.	Newcastle on Tyne 28927	Gosforth 54282
Durham County (South) and Teeside.	Dr. J. B. Robinson	Brierton Hospital and Chest Clinic, Brierton Lane, WEST HARTLEPOOL, Co. Durham.	West Hartlepool 5555	West Hartlepool 3271
Yorkshire, North Riding	Dr. C. W. Dixon	32, Hyde Terrace, LEEDS.	Leeds 27740	Collingham Bridge 136

Leeds Regional Hospital Area—No. 2

District	Name	Address	Hospital, Office or Surgery Telephone No.	Home Telephone No.
Whole area	Dr. E. C. Benn	Seacroft Hospital, LEEDS.	Leeds 45194	—
„ „	Dr. D. B. Bradshaw	25, East Parade, LEEDS.	Leeds 30661	Leeds 42290
„ „	Dr. I. G. Davies	25, East Parade, LEEDS.	Leeds 30661	Leeds 52339
„ „	Dr. C. W. Dixon	32, Hyde Terrace, LEEDS.	Leeds 27740	Collingham Bridge 136
Bradford, Halifax, Hudders- field and district.	Dr. H. L. Beach	Leeds Road Hospital, BRADFORD, Yorks.	Bradford 27125/6	—
„ „ „	Dr. J. J. Buchan	15, Heaton Grove, BRADFORD, Yorks.	—	Bradford 44599
York County Borough	Dr. A. Colbert	“Whinneyfield”, Tang Hall Lane, YORK.	—	York 4535
Yorkshire, East Riding	Dr. A. Hutchison	Guildhall, KINGSTON-UPON-HULL.	Kingston-upon- Hull 36880	—
„ „	Dr. R. L. Thornley	“Pinewood”, BEVERLEY, Yorks.	—	Beverley 51
Yorkshire, West Riding	Dr. J. Douglas	Town Hall, BRADFORD, Yorks.	Bradford 29543	Shipley 52331

Sheffield Regional Hospital Area—No. 3

District	Name	Address	Hospital, Office or Surgery Telephone No.	Home Telephone No.
Whole area	Dr. C. W. Dixon	32, Hyde Terrace, LEEDS.	Leeds 27740	Collingham Bridge 136
„ „	Dr. J. M. Kennedy	Lodge Moor Hospital, SHEFFIELD, 10.	Sheffield 31124	—
Derbyshire	Dr. A. D. Stoker	WINSTER, Derbyshire	—	Winster 207
Grimsby County Borough	Dr. A. N. S. Watt	148, Welhalme Road, GRIMSBY, Lincs.	—	Grimsby 2570
Leicestershire	Dr. W. D. Jeans	5, Elmfield Avenue, LEICESTER.	—	Leicester 78901
„	Dr. E. K. Macdonald	Grey Friars, LEICESTER.	Leicester 5118	Leicester 77307
„	Dr. J. R. Salmond	“Lindores”, Appleby Magna, BURTON-ON-TRENT, Staffs.	Measham 221	Measham 221
Lincolnshire, and the Don- caster area.	Dr. J. Glen	Springfield Hospital, Scarthoe, GRIMSBY, Lincs.	Grimsby 7234	Grimsby 7493
Lincolnshire (Holland and Kesteven).	Dr. J. H. C. Clarke	County Offices, SLEAFORD, Lincs.	Sleaford 241	Grantham 464
Lincolnshire (Holland and Kesteven) and Rutland.	Dr. G. Nisbet	Bridge Street, PETERBOROUGH, Northants.	Peterborough 2489	Peterborough 3327
Sheffield and district	Dr. T. E. Gumpert	70, Upper Hanover Street, SHEFFIELD, 3.	Sheffield 25522	Sheffield 31993
„ „	Dr. A. W. D. Leishman	18, Taptonville Crescent, SHEFFIELD, 10.	—	Sheffield 60147
„ „	Dr. E. G. Rhind	City General Hospital, Herries Road, SHEFFIELD, 5.	Sheffield 36253	Sheffield 50681
„ „	Dr. E. W. Skipper	2, Pollitt Street, BARNLEY, Yorks.	Barnley 2184	Sheffield 63847
Yorkshire, West Riding	Dr. J. Douglas	Town Hall, BRADFORD, Yorks.	Bradford 29543	Shipley 52331

East Anglian Regional Hospital Area—No. 4

District	Name	Address	Hospital, Office or Surgery Telephone No.	Home Telephone No.
Whole area	Dr. J. D. Kershaw	4, Trinity Street, COLCHESTER, Essex.	Colchester 5101	Colchester 3176
" "	Dr. R. A. Leader	Elm Street, IPSWICH, Suffolk.	Ipswich 55511	Ipswich 55388
" "	Dr. W. A. Oliver, M.B.E.	Norfolk and Norwich Hospital, NORWICH, Norfolk.	Norwich 21311	Norwich 22335
Lincolnshire	Dr. J. Glen	Springfield Hospital, Scartho, GRIMSBY, Lincs.	Grimsby 7234	Grimsby 7493
Lincolnshire (Kesteven)	Dr. J. H. C. Clarke	County Offices, SLEAFORD, Lincs.	Sleaford 241	Grantham 464
Norfolk	Dr. A. G. Smith	24, Unthank Road, NORWICH, Norfolk.	—	Norwich 26706
Soke of Peterborough, Lincolnshire (Kesteven), Huntingdonshire, and Isle of Ely.	Dr. G. Nisbet	Bridge Street, PETERBOROUGH, Northants.	Peterborough 2489	Peterborough 3327

North-West Metropolitan Regional Hospital Area—No. 5

District	Name	Address	Hospital, Office or Surgery Telephone No.	Home Telephone No.
Whole area	Dr. W. J. Coughlan	Joyce Green Hospital, DARTFORD, Kent.	Dartford 3231	—
" "	Dr. J. R. Hutchinson	" Kaduna ", GERRARDS CROSS, Bucks.	—	Gerrards Cross 2905
" "	Dr. J. P. Marsden	River Hospitals, Joyce Green, DARTFORD, Kent.	Dartford 3231	Dartford 2443
County of London	Dr. J. V. Armstrong	Brook General Hospital, Shooters Hill Road, LONDON, S.E.18.	Woolwich 1172	Woolwich 1172
" "	Dr. H. S. Banks	Park Hospital, Hither Green, LONDON, S.E.13.	Hither Green 3481	—
" "	Dr. R. Swyer	St. Ann's General Hospital, St. Ann's Road, LONDON, N.15.	Stamford Hill 0121	—
Bedfordshire (North)	Dr. G. Nisbet	Bridge Street, PETERBOROUGH, Northants.	Peterborough 2489	Peterborough 3327
Buckinghamshire	Dr. M. H. Summers	Burnham House, BURNHAM, Bucks.	—	Burnham 25
North of Thames and the adjoining Home Counties.	Dr. W. Gunn	Royal Free Hospital, Lawn Road, Hampstead, LONDON, N.W.3.	Primrose 7671	—

North-East Metropolitan Regional Hospital Area—No. 6

District	Name	Address	Hospital, Office or Surgery Telephone No.	Home Telephone No.
Whole area	Dr. W. T. Boul	34, Cresthill Avenue, GRAYS, Essex.	Tilbury 4641	Orsett 232
„ „	Dr. W. J. Coughlan	Joyce Green Hospital, DARTFORD, Kent.	Dartford 3231	—
„ „	Dr. J. D. Kershaw	4, Trinity Street, COLCHESTER, Essex.	Colchester 5101	Colchester 3176
„ „	Dr. J. P. Marsden	River Hospitals, Joyce Green, DARTFORD, Kent.	Dartford 3231	Dartford 2443
County of London	Dr. J. V. Armstrong	Brook General Hospital, Shooters Hill Road, LONDON, S.E.18.	Woolwich 1172	Woolwich 1172
„ „	Dr. H. S. Banks	Park Hospital, Hither Green, LONDON, S.E.13.	Hither Green 3481	—
„ „	Dr. M. Mitman	River Hospitals, Joyce Green, DARTFORD, Kent.	Dartford 3231	—
„ „	Dr. R. Swyer	St. Ann's General Hospital, St. Ann's Road, LONDON, N.15.	Stamford Hill 0121	—
Dagenham, Ilford and Romford Boroughs; Brentwood and Hornchurch Urban Districts.	Dr. E. James	Rush Green Hospital, ROMFORD, Essex.	Romford 7711	—
East Ham and West Ham County Boroughs; Barking, Chingford, Enfield, Hertford, Ilford, Leyton, Walthamstow, Wanstead and Woodford Boroughs; Cheshunt, Chigwell, Epping, Hoddesdon, Ongar, Saw- bridgeworth, Ware and Waltham Holy Cross Urban Districts.	Dr. R. W. Tannahill	Ilford Isolation Hospital, Grove Road, CHADWELL HEATH, Essex.	Seven Kings 3007	—
North of Thames and the adjoining Home Counties.	Dr. W. Gunn	Royal Free Hospital, Lawn Road, Hampstead, LONDON, N.W.3.	Primrose 7671	—

South-East Metropolitan Regional Hospital Area—No. 7

District	Name	Address	Hospital, Office or Surgery Telephone No.	Home Telephone No.
Whole area	Dr. J. S. Anderson	Grove Hospital, Tooting Grove, LONDON, S.W.17.	Balham 4271/2	—
„ „	Dr. J. P. Marsden	River Hospitals, Joyce Green, DARTFORD, Kent.	Dartford 3231	Dartford 2443
County of London	Dr. J. V. Armstrong	Brook General Hospital, Shooters Hill Road, LONDON, S.E.18.	Woolwich 1172	Woolwich 1172
„ „	Dr. R. Swyer	St. Ann's General Hospital, St. Ann's Road, LONDON, N.15.	Stamford Hill 0121	—
County of London and Kent (West).	Dr. H. S. Banks	Park Hospital, Hither Green, LONDON, S.E.13.	Hither Green 3481	—
„ „	Dr. W. J. Coughlan	Joyce Green Hospital, DARTFORD, Kent.	Dartford 3231	—
„ „	Dr. M. Mitman	River Hospitals, Joyce Green, DARTFORD, Kent.	Dartford 3231	—
Kent (East)	Dr. F. L. Cassidi	Longport House, CANTERBURY, Kent.	Canterbury 3540	Canterbury 2186
Sussex	Dr. W. S. Parker	Health Department, Royal York Buildings, BRIGHTON, Sussex.	Brighton 29801	Brighton 55791
Sussex and adjoining part of Kent.	Dr. R. J. Toleman	Town Hall, BEXHILL, Sussex.	Bexhill 936	Bexhill 955
Sussex (East)	Dr. G. K. Thornton	Lisnagh, FOREST ROW, Sussex.	—	Forest Row 135
Hailsham Rural District	Dr. H. F. Shaw	St. Wilfreds, HAILSHAM, Sussex.	Hailsham 181	Wilmington 124

South-West Metropolitan Regional Hospital Area—No. 8

District	Name	Address	Hospital, Office or Surgery Telephone No.	Home Telephone No.
Whole area	Dr. J. S. Anderson	Grove Hospital, Tooting Grove, LONDON, S.W.17.	Balham 4271/2	—
„ „	Dr. W. J. Coughlan	Joyce Green Hospital, DARTFORD, Kent.	Dartford 3231	—
„ „	Dr. J. P. Marsden	River Hospitals, Joyce Green, DARTFORD, Kent.	Dartford 3231	Dartford 2443
„ „	Dr. H. C. M. Williams, O.B.E.	Health Department, Civic Centre, SOUTHAMPTON.	Southampton 3855	Southampton 68862
County of London	Dr. J. V. Armstrong	Brook General Hospital, Shooters Hill Road, LONDON, S.E.18.	Woolwich 1172	Woolwich 1172
„ „	Dr. H. S. Banks	Park Hospital, Hither Green, LONDON, S.E.13.	Hither Green 3481	—
„ „	Dr. M. Mitman	River Hospitals, Joyce Green, DARTFORD, Kent.	Dartford 3231	—
„ „	Dr. R. Swyer	St. Ann's General Hospital, St. Ann's Road, LONDON, N.15.	Stamford Hill 0121	—
Dorset	Dr. C. Hollins	44, Maiden Castle Road, DORCHESTER, Dorset.	—	Dorchester 81
„	Dr. G. B. Scott	Holwell, SHERBORNE, Dorset.	Bishops Caundle 200	—
West Dorset Group H.M.C. Area.	Dr. P. Hughes	2, Bingleaves Road, WEYMOUTH, Dorset.	—	Weymouth 30
„ „	Dr. E. J. G. Wallace	Health Centre, Westham Road, WEYMOUTH, Dorset.	Wemouth 1645 and 16	Weymouth 1513
Hampshire	Dr. W. J. Hart	26, Edgar Road, WINCHESTER, Hants.	—	Winchester 5052
„	Dr. J. H. Pendered, M.C.	29, Westwood Road, SOUTHAMPTON.	Southampton 55300	—
Hampshire (South)	Dr. C. Banks	“Bramley”, Milvil Road, LEE-ON-SOLENT, Hants.	—	Lee-on-Solent 79249

Continued

South-West Metropolitan Regional Hospital Area—No. 8—*continued*

District	Name	Address	Hospital, Office or Surgery Telephone No.	Home Telephone No.
Isle of Wight	Dr. J. Mills	County Hall, NEWPORT, Isle of Wight.	Newport 2261 and 2106	Cowes 517
Surrey	Dr. C. A. McPherson	15, The Grove, WOKING, Surrey.	Woking 3510 Ottershaw 327	Brookwood 2260
Sussex	Dr. W. S. Parker	Health Department, Royal York Buildings, BRIGHTON, Sussex.	Brighton 29801	Brighton 55791
"	Dr. R. J. Toleman	Town Hall, BEXHILL, Sussex.	Bexhill 936	Bexhill 955
Wiltshire	Dr. J. S. Harper	County Hall, TROWBRIDGE, Wilts.	Trowbridge 3641 Extension 37	Trowbridge 2712
Amesbury Rural District	Dr. R. Mackay	Council Offices, 1, The Green, MARLBOROUGH, Wilts.	Marlborough 487	Ramsbury 260
Bournemouth and Poole (20 miles radius of).	Dr. George Chesney, O.B.E.	39, Pearce Avenue, PARKSTONE, Dorset.	Parkstone 21	Parkstone 1796
Portsmouth County Borough and Portsmouth H.M.C. Area.	Dr. I. M. McLachlan	Portsmouth Infectious Diseases Hospital, Milton Road, PORTSMOUTH, Hants.	Portsmouth 2046	—

Oxford Regional Hospital Area—No. 9

District	Name	Address	Hospital, Office or Surgery Telephone No.	Home Telephone No.
Whole area	Lt.-Colonel C. H. Barber, D.S.O., D.M.	Starbank House, THAME, OXON.	—	Thame 270
„ „	Dr. J. R. Hutchinson	“Kaduna”, GERRARDS CROSS, Bucks.	—	Gerrards Cross 2905
„ „	Dr. H. S. Le Marquand	2, Bath Road, READING, Berks.	—	Reading 3926
Berkshire (North)	Dr. T. Fisher	Broad Street, ABINGDON, Berks.	Abingdon 191	Abingdon 448
Buckinghamshire	Dr. M. H. Summers	Burnham House, BURNHAM, Bucks.	—	Burnham 25
Northamptonshire	Dr. W. P. Blackstock	Middleton, MARKET HARBOROUGH, Leics.	East Carlton 225 Corby 2239	Rockingham 320
„	Dr. W. D. Jeans	5, Elmfield Avenue, LEICESTER.	—	Leicester 78901
„	Dr. G. Nisbet	Bridge Street, PETERBOROUGH, Northants.	Peterborough 2489	Peterborough 3327
Wiltshire	Dr. J. S. Harper	County Hall, TROWBRIDGE, Wilts.	Trowbridge 3641 Extension 37	Trowbridge 2712
Marlborough Borough; Pewsey and Marlborough and Ramsbury Rural Districts.	Dr. R. Mackay	Council Offices, 1, The Green, MARLBOROUGH, Wilts.	Marlborough 487	Ramsbury 260

South Western Regional Hospital Area—No. 10

District	Name	Address	Hospital, Office or Surgery Telephone No.	Home Telephone No.
Whole area	Dr. J. Macrae	Ham Green Isolation Hospital, Ham Green, BRISTOL.	Pill 31311 and 31165/6	—
Cornwall and Devon	Dr. W. A. Lister	7, The Crescent, PLYMOUTH, Devon.	Plymouth 5701	Devonport 40
Cornwall, Devon, and adjacent parts of Somerset.	Dr. C. Seward	20, West Southernhay, EXETER, Devon.	Exeter 2110	Exmouth 4120
Gloucestershire (North)	Dr. R. M. Humphreys	Gloucestershire Royal Hospital, GLOUCESTER.	Gloucester 25061	Painswick 2345
Somerset	Dr. J. F. Coates	Friars Gate, BRIDGWATER, Somerset.	—	Bridgwater 2747
Wiltshire	Dr. J. S. Harper	County Hall, TROWBRIDGE, Wilts.	Trowbridge 3641 Extension 37	Trowbridge 2712
Clifton (25 miles radius of)	Dr. R. C. Clarke	Harley Lodge, Clifton Down, Clifton, BRISTOL.	—	Bristol 34953
Exeter County Borough	Dr. A. H. G. Down	1, The Mede, Whipton, EXETER, Devon.	Exeter 3805	Exeter 67121
Exeter (40 miles radius of)	Dr. W. J. Laird	Exeter City Hospital, Heavitree Road, EXETER, Devon.	Exeter 2671	Exeter 3116
Lyme Regis Borough	Dr. E. J. G. Wallace	Health Centre, Westham Road, WEYMOUTH, Dorset.	Weymouth 1645 and 16	Weymouth 1513
Plymouth County Borough and Cornwall.	Dr. D. F. Johnstone	The Isolation Hospital, PLYMOUTH, Devon.	Plymouth 4311 and 61437	Plymouth 3358

Welsh Regional Hospital Area—No. 11

District	Name	Address	Hospital, Office or Surgery Telephone No.	Home Telephone No.
North Wales	Dr. G. A. Kiloh	Chester Royal Infirmary, St. Martin's Fields, CHESTER.	Chester 21422	Chester 22071
„ „	Dr. E. R. Peirce	Port Health Offices, Pier Head, LIVERPOOL, 3.	Liverpool Central 0831/2 and 0723	Garston 1236
„ „	Dr. A. B. Semple	Public Health Department, Gordon House, Belmont Grove, LIVERPOOL, 6.	Anfield 2271	Gateacre 2081
South Wales and Monmouthshire.	Dr. G. E. Harries	City Isolation Hospital, CARDIFF.	Cardiff 21466	—
Glamorgan	Dr. G. F. J. Thomas	St. David's Hospital, 30A, Cowbridge Road, CARDIFF.	Cardiff 20441	Llandaff 679

Birmingham Regional Hospital Area—No. 12

District	Name	Address	Hospital, Office or Surgery Telephone No.	Home Telephone No.
Whole area	Dr. F. L. Ker	Little Bromwich Hospital, BIRMINGHAM, 9.	Victoria 0957	—
„ „	Dr. W. R. Martine, O.B.E., T.D.	Public Health Department, Congreve Street, BIRMINGHAM, 3.	Birmingham Central 7000 Extension 60	Harborne 1372
Herefordshire and Worcester-shire.	Dr. C. F. J. Cropper, O.B.E.	Ronkswood Hospital, WORCESTER.	Worcester 4335	Worcester 2622
Staffordshire and Warwick-shire.	Dr. J. R. Salmond	“Lindores”, Appleby Magna, BURTON-ON-TRENT, Staffs.	Measham 221	Measham 221
Staffordshire, Warwickshire and Worcestershire.	Dr. M. Burn, M.C., M.M.	Public Health Department, Congreve Street, BIRMINGHAM, 3.	Birmingham Central 7000 Extension 52	Priory 3478
„ „ „	Prof. J. M. Smellie, O.B.E.	The Children's Hospital, Ladywood, BIRMINGHAM, 16.	Edgbaston 4851	Edgbaston 3183
Staffordshire (North)	Dr. P. B. L. Muldoon	“Stoneyfields”, King Street, NEWCASTLE-UNDER-LYME, Staffs.	Newcastle-under-Lyme 65205	Trentham 49448
Warwickshire	Dr. S. Whittaker	Warwick General Hospital, Lakin Road, WARWICK.	Warwick 760	Leamington Spa 702

Manchester Regional Hospital Area—No. 13

District	Name	Address	Hospital, Office or Surgery Telephone No.	Home Telephone No.
Whole area	Dr. D. C. Liddle	Monsall Isolation Hospital, Newton Heath, MANCHESTER, 10.	Collyhurst 2254	Collyhurst 1944
" "	Dr. E. R. Peirce	Port Health Offices, Pier Head, LIVERPOOL, 3.	Liverpool Central 0831/2 and 0723	Garston 1236
" "	Dr. A. B. Semple	Public Health Department, Gordon House, Belmont Grove, LIVERPOOL, 6.	Anfield 2271	Gateacre 2081
Cheshire	Dr. G. A. Kiloh	Chester Royal Infirmary, St. Martin's Fields, CHESTER.	Chester 21422	Chester 22071
Cheshire, Derbyshire and Lancashire (South-East).	Dr. J. Yule	Town Hall, STOCKPORT, Cheshire.	Stockport 4940 Extension 303	Stockport 4136
Cheshire and Lancashire	Dr. C. Metcalfe-Brown	Town Hall, MANCHESTER, 2.	Manchester Central 3377	Ringway 4273
Derbyshire	Dr. A. D. Stoker	WINSTER, Derbyshire	—	Winster 207
Manchester and district	Dr. W. McClure	19, Didsbury Court, MANCHESTER, 20.	—	Didsbury 1161
Lancashire (North) and Westmorland.	Dr. R. W. Farquhar	Victoria House, Regent Street, LANCASTER.	Lancaster 4353	Caton 194

Liverpool Regional Hospital Area—No. 14

District	Name	Address	Hospital, Office or Surgery Telephone No.	Home Telephone No.
Whole area	Dr. C. Metcalfe-Brown	Town Hall, MANCHESTER, 2.	Manchester Central 3377	Ringway 4273
" "	Dr. E. R. Peirce	Port Health Offices, Pier Head, LIVERPOOL, 3.	Liverpool Central 0831/2 and 0723	Garston 1236
" "	Dr. A. B. Semple	Public Health Department, Gordon House, Belmont Grove, LIVERPOOL, 6.	Anfield 2271	Gateacre 2081
Cheshire	Dr. G. A. Kiloh	Chester Royal Infirmary, St. Martin's Fields, Chester	Chester 21422	Chester 22071
"	Dr. J. Yule	Town Hall, STOCKPORT, Cheshire.	Stockport 4940 Extension 303	Stockport 4136

SCOTLAND

Name	Address	Hospital, Office or Surgery Telephone No.	Home Telephone No.
Sir Alexander Biggam	Tropical Diseases Unit, Eastern General Hospital, Seafield Road, EDINBURGH, 6.	Leith 35463	—
Dr. Alexander Joe	City Infectious Diseases Hospital, Greenbank Drive, EDINBURGH, 10.	Edinburgh 51001	—
Dr. R. H. A. Swain	Virus Laboratory, Department of Bacteriology, University of Edinburgh, Teviot Row, EDINBURGH, 8.	Edinburgh 41001 Extension 35	—
Dr. Thomas Anderson	Ruchill Hospital, Bilsland Drive, GLASGOW, S.2. or Admission Department, Public Health Department, Montrose Street, GLASGOW, C.1.	Glasgow Maryhill 3232 Glasgow Central 9600	Glasgow Western 5842 —
Dr. A. Girdwood Fergusson	As for Dr. Anderson		—
Dr. N. R. Grist	Virus Laboratory, Infectious Diseases Department, Ruchill Hospital, Bilsland Drive, GLASGOW, S.2.	Glasgow Maryhill 3232	—
Dr. Joan B. Landsman	As for Dr. Anderson		—
Dr. J. Bennet	Hospitals Management Board, 243A, High Street, KIRKCALDY.	Kirkcaldy 3428/9	—

NORTHERN IRELAND

Name	Address	Hospital, Office or Surgery Telephone No.	Home Telephone No.
Dr. E. Fletcher	4, University Terrace, BELFAST.	—	Belfast 20632
Dr. F. F. Kane	Northern Ireland Fever Hospital, Purdysburn, BELFAST.	Belfast 41212	—
Dr. William Lennon	4, Malone Road, BELFAST.	—	Belfast 67418
Dr. R. J. Kernohan	"Fairfield", Ballymarlow, BALLYMENA, Co. Antrim.	—	Ballymena 6286
Dr. P. J. Sweeney	Fermanagh County Hospital, ENNISKILLEN, Co. Fermanagh.	Enniskillen 2332	—

